Citation:

Price GM, Uauy R, Breeze E, Bulpitt CJ, Fletcher AE. Weight, shape, and mortality risk in older persons: Elevated waist-hip ratio, not high body mass index, is associated with a greater risk of death. *Am J Clin Nutr*. 2006 Aug; 84(2): 449-460.

PubMed ID: 16895897

Study Design:

Prospective Cohort Study

Class:

B - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To determine the relationship between body mass index (BMI), waist circumference and waist and hip circumferences with mortality in older persons (75 years or older).

Inclusion Criteria:

Males and females more than 75 years old.

Exclusion Criteria:

- Males and females less than 75 years
- Residents of long-term nursing institutions
- Males and females known to be terminally ill.

Description of Study Protocol:

Recruitment

- Participants were recruited through 106 family practices in the United Kingdom
- Practices were randomly assigned to universal or targeted assessments
- In the universal arm, all participants were invited to have an in-depth health assessment by a study nurse
- In the targeted arm, only selected patients were invited.

Design

Prospective cohort study design.

Statistical Analysis

- Data analysis was conducted using STATA software
- BMI and waist-to-hip ratio (WHR) indexes were calculated
- Anthropometric data were categorized into quintiles by gender and mortality risk using Cox regression models
- Three-way interactions were tested between BMI, WHR and waist circumference with gender and current smoking status for all-cause and circulatory mortality
- All models were adjusted for the linear effects of height and age
- Potential confounders were identified from the detailed health assessment. Confounders included psychosocial factors, cognitive impairment, socioeconomic factors, former smoking, recent alcohol use and unexplained recent weight loss
- Analyses were conducted with additional adjustment for covariates that were potentially or partially associated with body composition. These covariates included self-reported history of cancer, heart attack, stroke, diabetes, respiratory disease; the number of falls in the previous six months; concurrent angina and respiratory symptoms; sitting systolic blood pressure (SBP); physical activity
- Additional analyses explored the effects of excluding the first one and two years of follow-up and restricting the analysis across the full follow-up period to a subset of participants defined as healthy
- Robust SEs were used to take account of the study design of 53 of the practices by using the cluster option for Cox regression and the Survey functions in STATA software for cross tabulations
- Robust SEs were also used to calculate 95% confidence intervals (CI) and design-adjusted Wald tests of significance were reported for regression models.

Data Collection Summary:

Timing of Measurements

- Oral informed consent was obtained from all participants
- One-third of assessments were completed in participant's own homes. The remainder of assessments were completed in the family practitioner's office or in retirement or assisted living homes
- Median follow-up was completed at 5.9 years and included mortality determination and cause only.

Dependent Variables

- All-cause mortality
- Circulatory mortality.

Independent Variables

- BMI
- Waist circumference
- Waist-to-hip ratio.

Control Variables

Cigarette smoking.

Description of Actual Data Sample:

- *Initial N:* N=15,160 (males, N=5,811; females, N=9,349)
- *Attrition (final N):* N=13,036 (gender not reported in final N)
- *Age:* 75 to 86.4 years
- *Other relevant demographics:*
  - Cigarette smoking
  - Alcohol consumption
  - History of cancer
  - History of cardiovascular disease
  - History of diabetes
  - History of respiratory disease
  - Physical activity
- *Anthropometrics:*
  - BMI
  - Waist circumference
  - Height
- *Location:* The United Kingdom.

Summary of Results:

- During the median follow-up time period of 5.9 years, 6,649 subjects died, with 46% dying from circulatory causes
- In the non-smoking men and women (90% of the cohort), compared with the lowest quintile of BMI (less than 23kg/m^2 in men, less than 22.3kg/m^2 in women), adjusted hazard ratios (HR) for mortality were less than 1 for all other quintiles of BMI (P=0.0003 and P=0.0001 in men and women, respectively)
- Increasing WHR was associated with increasing HRs in men and women (P=0.008 and P=0.002 for men and women, respectively)
- BMI was not associated with circulatory mortality in men, and was negatively associated with circulatory mortality in women (P=0.004)
- WHR ratio was positively related to circulatory mortality in both men (P=0.001) and women (P=0.005)
- Waist circumference was not associated with all-cause or circulatory mortality.

Other Findings

- Results are limited by the number of smokers in this age group (613 males, 639 females)
- Deaths due to other causes were not reported because of small numbers.

Author Conclusion:

- The authors conclude that current BMI-based health risk categories currently used to define health risks related to obesity are not appropriate for persons aged 75 years or older
- Waist-to-hip ratio would be a better indicator of health risks based on the positive relation with risk of death in this study
- More attention should be given to the problem of underweight in old age as well.

Reviewer Comments:

The authors not several limitations:

- *Measurements were taken at a single time point with no information on previous or subsequent measurements, other than a question about previous weight loss. Unable to get information on changes in weight*
- *No direct measures for body fat or muscle composition*
- *Random errors in measurements may have occurred*
- *No information on ethnicity, since proportion of ethnic minorities in the UK is very small. Results may not be applicable to ethnic populations*
- *Data from the nursing population was not collected. Results may not be applicable to the nursing home population (frail elderly).*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions		
1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	Yes
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes

Validity Questions		
1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	N/A
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	N/A
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes

2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	Yes
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	???
4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	No
4.4.	Were reasons for withdrawals similar across groups?	???
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	Yes

5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	Yes
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	N/A
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	N/A
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes

8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	???
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes